

# 1 Governance of Sustainable Development in Knowledge Democracies—Its Consequences for Science

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## Abstract

Governance is the way in which a society organizes decision-making. Advanced societies turn into knowledge democracies where the relationships between politics, media and science intensify and change continuously. The concept of knowledge democracy embraces participatory democracy besides representative democracy, the rise of social media besides corporate media, the emergence of transdisciplinary trajectories besides classical disciplinary science with complex interactions that also change. The quest for sustainable development takes place within knowledge democracies, where sustainability covers economic, social and ecological issues, whose governance is complex. The future direction and content of sustainable development depend on uncertain future determinants such as technological innovation and the evolution of social values. The precautionary principle as a powerful moral imperative has its limitations. The multidimensional nature of sustainability requires integration and a recognition of a multilevel, multiscale, multidisciplinary character. Development refers to change, transitions and transformations. Governance of sustainable development has to cope with complex dynamics. Governance that furthers transitions focuses on the interaction between representative and participatory democracy, and the optimalization of the contribution of science. This chapter addresses the specific consequences for science, in particular the organization of science, relating both to disciplinary research and transdisciplinarity.

**Keywords:** Sustainable development, knowledge democracy, science, transdisciplinarity.

## 1.1 Introduction

Sustainable development can be described as a normative notion presenting the preferred evolution of society. The realization of sustainable development demands change in many domains. These changes can be described as transformations or transitions. Governance presents in a normative manner how a society organizes its decision-making. Governance of sustainable development has specific characteristics dependent on its complexity. This chapter concentrates on the necessary changes in the organization of science as an essential component of the governance of sustainable development.

Representative parliamentary democracy is an essential part of governance. Representation gradually became the predominant mechanism by which the population at large, through elections, provided a body with a general authorization to take decisions in all public domains for a certain period of time. Rep-

resentative parliamentary democracy became the icon of advanced nation states.

The recent decline of representative parliamentary democracy has been noted by many authors (Castells 1996, 2009; Dahrendorf 2002). Media politics destroys the original meaning of representation. The evolution of political parties to marketeers in the political realm destroys their capacity for designing consistent broad political strategies. Like willow trees they move with the winds of the voters' supposed preferences. Volatility therefore has increased. *This is dramatic, because important challenges like sustainable development demand consistent policies over a longer time period.*

The debate on the future of democracy has not yet led to major innovations in advanced societies in Europe. Established political actors try to tackle populism with trusted resources: a combination of anti-populist rhetoric and adoption of the populist agenda. Some media have tried to become "more

populist than populists themselves”, almost always at the expense of analytical depth. The development in different parts of the world points to various directions: in parts of South America city government is characterized by remarkable citizens’ participation, while in Asia the rule of law is introduced without classical democracy in influential nations. Meanwhile, the Internet and the evolution of social media provide for a drastic change in the rules of the game. A better-educated public has wider access to information, and selects it increasingly itself, instead of relying on media filters by classical media. Moreover, citizens themselves have become prosumers (simultaneously producing and consuming): they utilize social media as consumers but also produce YouTube pictures at home.

At the national level, representative democracy must find new ways of interacting with various forms of bottom-up participatory democracy. The relationships between corporate, top-down media and politics have considerably changed due to the rise of social media because politicians may utilize social media to directly communicate with voters, reducing their dependence on the top-down media. The corporate media are no longer the sole necessary intermediaries between politicians and voters.

But people get also tired of social media, because the latter produce information of different quality, increasing the costs of finding trustworthy information and producing confusion and ambiguity. In most social media no editor exists. There is no selection of information on the basis of quality to enable consumers to minimize their costs of searching.

The crucial combination of a network society and media politics (Castells 1996, 2009) provides new problems and tensions. The political agenda is increasingly filled with so-called wicked problems, characterized by the absence of consensus both on the relevant values and on the necessary knowledge and information. Uncertainty and complexity prevail. Wicked problems cannot be ‘solved’ in a classical way but it is possible to live with them (Hajer 2003, 2005; Hoppe 2008, 2010; Meuleman 2013). *Sustainable development is characterized by the presence of major wicked problems.*

In general contemporary societies experience an increasing intensity and speed of reflexive mechanisms (In 't Veld, 2009, 2010, 2012). In a more or less lenient political environment reflexive mechanisms cause overwhelming volatility of bodies of knowledge about social systems. As all available knowledge is utilized to facilitate reflexive processes, their result might establish new relationships undermining existing knowledge. Social reality has thus become unpredicta-

ble in principle. Both knowledge and information are increasingly volatile and are surrounded by uncertainty.

In their introductory chapter to *Reflexive Governance to Sustainable Development*, Voß and Kemp (2006) deal with reflexivity and distinguish between first- and second-order reflexivity. First-order reflexivity “refers to how modernity deals with its own implications and side effects, the mechanism by which modern societies grow in cycles of producing problems and solutions to these problems that produce new problems. The reality of modern society is thus a result of self-confrontation” (Voß/Kemp 2006: 6). Second-order reflexivity concerns “the cognitive reconstruction of this cycle”. It “entails the application of modern rational analysis not only to the self-induced problems but also to its own working, conditions and effects”.

The relationships between science and politics demand new designs in an environment of media politics, wicked problems and reflexivity. Jasanoff’s (2003, 2004) classical theory on boundary to cope with existing gaps between science and politics is now widely accepted among experts. The underlying insight is that scientific knowledge by its very structure never directly relates to action, because it is fragmented, partial, conditional and immunized. This observation applies to both mono- and multidisciplinary knowledge. Translation activities are always necessary to utilize scientific knowledge for policy purposes.

The literature on transdisciplinary research is dominated by process-directed normative studies. The key concept of transdisciplinarity should be defined as the trajectory in a multi-actor environment from a political agenda and existing expertise to a robust, plausible perspective for action. Thus, in the terminology of Voß and Kemp we mainly deal with second-order reflexivity.

We try to explore the relationships between disciplinary research and transdisciplinarity further, and to come up with several recommendations for the future organization of science.

## 1.2 Sustainable Development

The concept of sustainability deals with three key dimensions of human societies, the economic, social and ecological dimensions, as the three P’s: people, planet, profit. This implies that multiple changes are relevant regarding sustainable development, not only ecological dynamics.

Statistics indicate that on average human beings live longer and in better health than ever before, but the pursuit of happiness relates to more than statistics. Our values concerning distributive justice urge us to pay attention to differences. Many normative environmental perspectives are formulated in terms of threats that require immediate action. While increasing wealth appears to reduce the willingness to accept risks of wealthy people (Beck 2003, 2009), these threats are shaped as extreme risks.

Humankind is now able to cause irreversible change that partially diminishes the options of future generations. The normative insight derived from this principle is formulated as the precautionary principle, which leads to the norm that we should abstain from action that reduces the choice among valuable future options.

The reconciliatory character of sustainable development raises specific questions for judgment about changes that lead to improvement in two dimensions but to a deterioration in the third. Until now we have lacked a satisfactory interdimensional measuring rod in order to evaluate this type of changes. This deficiency is serious because as a consequence we are unable to provide convincing criteria to judge policy options in a comparative manner. In real-life situations Pareto-optimal solutions are exceptions. The remembrance of the slow death of welfare economics as an academic subdiscipline should warn us: the inability of welfare economics to formulate convincing policy recommendations in cases of non-Pareto-optimal situations appeared to be the main cause of its death (In 't Veld 1975).

Many different dialogues on sustainable development occur simultaneously. It functions as a unifying concept because its vagueness breeds a consensus that might be later used. It is an asset if it triggers action. On the other hand, if sustainable development is everything, maybe it is nothing. Although—or maybe because—the concept is so vague, it has overwhelming appeal on political agendas and in programmes and dialogues.

Sustainable development is a container notion. The use of the singular form fits holistic viewpoints. The supporters of these viewpoints speak about *the* climate, *the* earth, *the* emissions, *the* planetary boundaries (Meuleman 2013; In 't Veld 2011), which are all at stake, and disasters threaten. Such constructs enable us subsequently to deal with a global challenge that should be addressed in a well-coordinated manner. Thus, the normative construction of the problematique leads to a specific line of argumentation on

governance. Once again it appears that framing is normative. The supporters of this view may be found in international organizations that make continuous efforts to produce consensus on internationally binding agreements to prevent disasters. Basic metaphors like the exhaustion of the earth and planetary boundaries are then very useful.

However, people do not experience *the* climate but a climate in the neighbourhood. They pursue a good life according to their own values and in many cases try to find a satisfactory relationship with the surrounding nature. Their visible world is not abstract or systemic but specific and concrete. Likewise, until a few years ago, climatologists distinguished many different climates.

Entrepreneurs make attempts to design and apply more sustainable technologies. They act in a specific environment too, not in an abstract universe. Not just perceptions are context-bound but also acceptable ways of dealing with problematic issues.

Thus, major discrepancies may exist here between the systemic world and daily life. Those who recognize the twofold framing of sustainable development will prefer multiple politics and policies on different scales, with both top-down and bottom-up influence.

The Western world has developed environmental policies during the last half century. In the international realm younger nation states, often former colonies, more recently also become aware of the disagreeable side effects of economic growth. They want to counterbalance these effects in their own manner. However, in the diplomatic arena they are continuously confronted with urgent calls to participate in bargaining processes on treaties with the former colonial powers. These partners now urge dramatic reductions of emissions and the like. Quotas for a certain future year are symbols of urgency. The young nation that is coping with the need for reduction of backwardness in technologies and is just starting to think about clean technologies will not feel inspired by the short-term limits set by others. It will experience those as unnatural.

Cultural diversity should be recognized both as a component of sustainability and as a complicating factor that prohibits progress in reaching consensus on collective action. A society needs a certain cohesion that is produced as a moral order, based on consensus about some fundamental values and norms. Culture within a society also implies the sharing of some common substantial and relational values. A society consists of configurations that possess a specific culture but—as observed earlier—this leads to outside walls (In

't Veld, 2009; Teisman 2009). Thus, tensions arise. In particular the tensions between emerging identities on one side, accompanied necessarily by outer walls, and the need for cohesion and collective action on the other will never disappear. Thus, shaping governance is walking a high wire.

We should argue that both biodiversity and cultural diversity are components of sustainability. We may mourn the loss of a language somewhere on this globe and the loss of a species. But our general attitude towards cultural diversity in daily practice is far more critical than towards biodiversity. We do not believe that each culture is intrinsically good. On the contrary, some cultures are horrifying to many. As sustainability also implies the economic and social dimension, we realise that “diversity always is a bedfellow of inequality” (Van Londen in De Ruijter 2011: 14). Inequality might be a threat to sustainable development. So our attitude towards cultural diversity is ambiguous. In other terms, we do not embrace the precautionary principle for culture. *The full recognition of cultural diversity as a major component of sustainability delivers a strong argument against uniform global governance of transitions and transformations.*

According to the concept of second modernity (Beck 1997, 2006), it is probable that from the tense relations between emerging opposites variety increases. Striving at sustainable development urges us to take these tensions fully into account when dealing with governance.

Because sustainable development is a long-range trajectory, with considerable uncertainty and lack of forecasting options, the notion of resilience is crucial: like Noah we can act sensibly without any certainty about future events by answering the question of how to avoid a disaster, *in casu* by building an Ark. Nowadays, for instance, it is uncertain which theory about climate change is the right one, but once the theory that allies climate change to carbon emissions is there, the justification of measures to reduce emissions can be based on the resilience norm: in order to avoid disasters we have to take into account the feasible theoretical viewpoints irrespective of our beliefs.

We should realise in accordance with the view of Grunwald (2004), Grin (2006) and others that the plurality of notions of sustainable development and their normative origins and connotations lead to the necessity to consider the recommendable knowledge-producing and policy-making processes as reflexive. In Grunwald's terminology: “The normative character of the imperative of sustainability, its inseparable connection with deep-rooted societal structures and val-

ues, the long-term nature of many relevant developments, as well as the often necessary inclusion of societal groups and actors, result in specific demands on scientific problem-solving contributions. Research for sustainable development is a particularly marked type of post-normal science (Funtowitz/Ravetz 1993: 151)”. Therefore we argue that dealing with reflexivity and transdisciplinarity are necessary once we strive for sustainable development.

### 1.3 Knowledge Democracy

Representative democracy has been a successful governance concept for societies (In 't Veld, 2010). During the last two centuries, several forms of representative constitutional democracy developed at the national level and democracy is recommended by Western and most Southern political leaders as the preferred system of rule.

In the twentieth and twenty-first centuries parliamentary democracy, politics and media have become more interdependent; policies are increasingly funded in science, but at the same time science relies on public resources, which is why the linkages between politics and science have intensified. There have been large cognitive and emotional investments in current democratic institutions. As a consequence the stability of these institutions is embraced. Resistance to change has been considerable. But exogenous and endogenous developments threaten the continued success of representative parliamentary democracy.

The recent decline in acceptance, legitimacy and effectiveness of representative parliamentary democracy has been noticed by many authors (In 't Veld 2009, 2010). Three intertwining simultaneous developments have taken place on the macro-, meso- and micro-level of societies, with important effects. On the micro-level of the individual citizen, the classical assumption of a consistent individual position, based on an ideologically-based consistent value pattern, has disappeared. Separate values prevail but the glue of a focal ideological principle often no longer exists. Fragmentation of values has resulted in individualization and uniqueness but also in the impossibility of being represented for all different purposes by a single actor such as a member of parliament. None of the values cherished by an individual may be unique, but the combination probably is. The preference of individuals to be partially represented by a *non-governmental organization* (NGO) per value-domain is therefore no mistake, but a logical evolution. On the

meso-level the development of political parties to marketeers who try to optimize their future votes in the political realm destroys their capacity to design broad and consistent political strategies. And on the macro-level media politics dominate. As a consequence the epicentre of politics has shifted from parliament to the media. Media can handle personalities better than programmes.

Personalities instead of programmes become the major focus for selection and therefore the voters choose personalities. In the attempt to maximize their votes, political parties are keen to use the media, as it is only possible to actually ‘sell’ personalities through mass media. This of course significantly increases the structural dependence of politicians on the mass media. The classical function of democracy of protecting the people against tyranny and random or arbitrary action by rulers is endangered by stressing personalities over programmes. But media politics destroy the original meaning of representation.

We now envisage a world where representative democracy is enhanced with participatory democracy, in which social media are added to classical corporate top-down media, and in which disciplinary science is increasingly accompanied by transdisciplinary trajectories. The evolutionary patterns at each corner of the triangle are not without tensions: the institutions towards the centre of the triangle feel threatened by the younger ones at the edges. Each corner in the triangle is prone to profound change, as indicated in the second-order relationships:

- the bottom-up media not only supplement the classical media, but compete with them;
- participatory democracy is complementary to representative democracy but is also seen as a threat to it;
- transdisciplinary research designs are not only a bridge between classical science and the real world but also produce deviant knowledge and insights, which may challenge the disciplinary viewpoints.

The Internet, better education and other societal changes have made knowledge accessible to many more people than in the past. This leads to an abundance of knowledge and information that needs to be interpreted. It also leads to different types of knowledge: not only scientific knowledge appears to be relevant, but also citizens’ knowledge. This is a huge challenge for policymakers, for scientists and for the media. Politics is not just about how knowledge can be selected for political decisions, but also about how

democratic decision-making processes should change in order to incorporate the different types of knowledge adequately.

Moreover citizens themselves have become producers: any citizen may produce a YouTube picture that is world-famous within two days.

The classical media suffer from the new ones: not only in a commercial sense, but also because of the influence of the new media. We call the new media the bottom-up media in order to distinguish them from the classical top-down media. This distinction does not imply that the top is more powerful than the bottom. An increasing series of empirical counterproofs is available. Many new media do not have an editor: nobody accepts the obligation to select the rubbish from the trustworthy materials. The developments within and with the media are confusing. Our capacity to observe and to interpret adequately seems to be deficient. Information and knowledge of very different origins are available within a second but it is hard to judge quality. As usual in second modernity the top-down media do not disappear altogether but develop innovative strategies, accepting Internet options and modes of cooperation with social media. The social media are in the process of discovering their own deficiencies, and in some cases organize a revival of editorial functions. The ‘wicked’ character of many problems on the political agenda sheds a fascinating light on the complexities caused by the interaction of top-down and bottom-up media.

Both contribute to the agenda-setting of politics. The top-down media operate in structural interdependency with politics. The expression ‘media politics’ refers to this interdependency. The bottom-up media are to a considerable degree independent from both the top-down media and politics. Participation in decision preparation and -making may be invited by public authorities, but uninvited participation also occurs, in particular with support from bottom-up media. It is too early to draw consolidated conclusions on this development: it is fluid, fast and reflexive, and also unpredictable.

The current global economic situation raises new, very challenging questions that are mainly about the institutional frameworks of today’s societies. It is therefore time for a transition to a new concept that concentrates on institutional and functional innovation. As the industrial economy has been combined with mass democracy through universal suffrage and later by the rise of mass media, one might suggest that the logical successor is a new type of governance, to be called ‘knowledge democracy’.

Which challenges and threats are we facing? How will parliamentary and new direct forms of democracy mix, and which roles will knowledge play in the transition towards a knowledge democracy? The crucial combination of a network society and media politics provides new problems and tensions. Today policy-making in many instances is evidence- or knowledge-based, providing both legitimacy and effectiveness, according to its supporters. Effectiveness is assured as the knowledge concerns true statements about the relationships between political interventions and their societal effects. The argument runs thus: according to them, legitimacy is enhanced when the policies are based on 'objective' truth. It is easy to undermine this belief.

Scientific research is a specific form of research, aimed at the creation or accumulation of scientific knowledge. Classical scientific research is performed within disciplines, specialized branches of science with specific theories and methodologies. A discipline studies an aspect of reality, not reality itself. A disciplinary methodology consists of several approved conditions under which truth claims are accepted.

This mono-disciplinary knowledge is methodologically formalized in a particular way: for example it is subject to peer review. It is often put into a rule-based form, such as: 'A implies B' in a particular set of circumstances, whenever these circumstances occur. Such an assertion is known as a hypothesis. 'The more a child participates in sports, the less likely the child is to turn to drugs', is a statement which could originate from empirical research and which probably applies to white families in European cities since 1990, but not to rural areas in Colombia. And why should this statement be true in the future? Scientific knowledge is therefore by definition both fragmented and conditional. Its scientific value depends on the correct application of the agreed methodology. Scientific knowledge requires validity, and methodology protects against criticism. This is called 'normal research'.

It is difficult to integrate different areas of scientific knowledge because scientific knowledge is by its very nature fragmented. And its conditional character means that in order to apply the knowledge in real-world situations, it is necessary to verify whether the relevant characteristics of the situation in which the original study was performed have been complied with. Regarding the future, this question can never be definitively answered. This means that every application of social scientific knowledge for the purpose of policy implies an element of risk.

If a policymaker—in the course of preparing policy proposals—wishes to apply an assertion which is based on a rule, such as 'for every X, under condition Y: A implies B', she/he first has to verify:

- 'Is the X that I am talking about the same X as in the assumption?'
- 'Are the conditions which I am faced with the same as the Y in the assumption?'
- 'Is there really an A in my situation?'
- 'Will the implication still apply at the time when the policy is implemented?'

In particular the last question is a nasty one because the consciousness of reflexivity urges us to wonder whether the drug dealers might have reflected upon the research results too, and might have ensured for themselves a position on the boards of the sports clubs.

This implies that applying scientific knowledge in policy does not always and should not follow the accepted route of meeting the methodological requirements which applied when the knowledge in question was developed. The application of scientific knowledge in a political and governmental context is an exercise in uncertainty, partly based on suppositions, and it also requires competences other than scientific ones, such as social intelligence and well-developed social intuition. It appears necessary to link scientific knowledge to other types of insights without detracting from its relevance and usefulness. Combining knowledge from different scientific disciplines and mixing it with other insights is an opportunity to try to maintain the relevance and usefulness of such knowledge in the relevant application. Multi-, inter- and transdisciplinary developments in research are in full swing. Anyone who realizes this cannot fail to be impressed by the speculative nature of many elements of the methods used. The precision of a great deal of scientific knowledge very soon gets lost in these methods. Robust concepts are often unrefined. As Silvio Funtowicz has repeatedly explained, this image of evidence-based policies based on 'sound' knowledge is not adequate according to the advanced science model (Funtowicz/Ravetz 1991, 1992, 1993). Let us now state that knowledge about social systems is by definition volatile as a consequence of the reflexivity we discuss below. The predominant position of 'wicked problems' on political agendas as indicated earlier is the main reason that linear problem-solving strategies cannot be used. Wicked problems cannot be solved, but they can be managed. In many cases interactive processes are part of effective management.

Today's societies are characterized by the increasing intensity and speed of reflexive mechanisms. We define reflexive mechanisms as events and arrangements that bring about a redefinition of the action perspectives, the focal strategies of the groups and people involved, as a consequence of mindful or thoughtful considerations concerning the frames, identities, and the underlying structures of themselves as well as other relevant stakeholders. Defined in this manner, reflexivity has to do with a particular kind of learning potential. Reflexive systems have the ability to reorient themselves and adapt accordingly based on available self-knowledge.

Reflexive mechanisms in a more or less lenient political environment cause the overwhelming volatility of bodies of knowledge related to social systems. As all available knowledge is utilized to facilitate reflexive processes, the result of such processes might establish new relationships that undermine the existing knowledge. Social reality has then become unpredictable in principle. The efficacy of reflexive mechanisms is furthered by institutional arrangements that enable individual liberty and tolerance.

It is necessary to develop this notion of reflexive learning further because it is of utmost importance for the design of an advanced way of thinking on policy-making: we should realize that a social theory of any kind may never be used to create policy measures without an additional research effort on the specific issue. Such an effort should include the question of whether it is probable or plausible that the theory is already undermined by reflexive reactions in or around the target group of the measure. This latter effort will never deliver results with an absolute truth claim. So uncertainty is overwhelmingly present there too. The policy dialogue will then be characterized by different layers of uncertainty, and so by a discussion about the impact of the different layers of uncertainty too.

Evidence-based policy-making as a normative concept probably bears some relevance when it concerns the application of a physical, chemical or biological scientific theory. But it becomes a hazardous pretention if the decision support comes from a theory in the social sciences for the reasons just explained. Thus, the fashionable approach towards evidence-based policies in social domains should be moderated in a more modest and thoughtful framework.

Knowledge democracy could become an emerging concept with political, ideological and persuasive meaning. The concept of knowledge democracy is meant to enable a new focus on the relationships between knowledge production and dissemination,

the functioning of the media and our democratic institutions.

The media are far from neutral or passive. The illusion that they are a neutral mirror of reality belongs to a forgotten past. We have already shed light on the relationships between politics and media. Media create realities; they also produce knowledge, and moreover report on citizens' knowledge. They are the reporters on scientific findings but also competitors of scientists. The same goes for the relationships between media and citizens.

Moreover, citizens utilize social media independently from authorities either in order to mobilize support for ideas, or to attack existing policy theories. Science is involved in fierce competition, in continuous marketing efforts in order to gain support for viewpoints based upon research and aiming at the acquisition of public resources for further research.

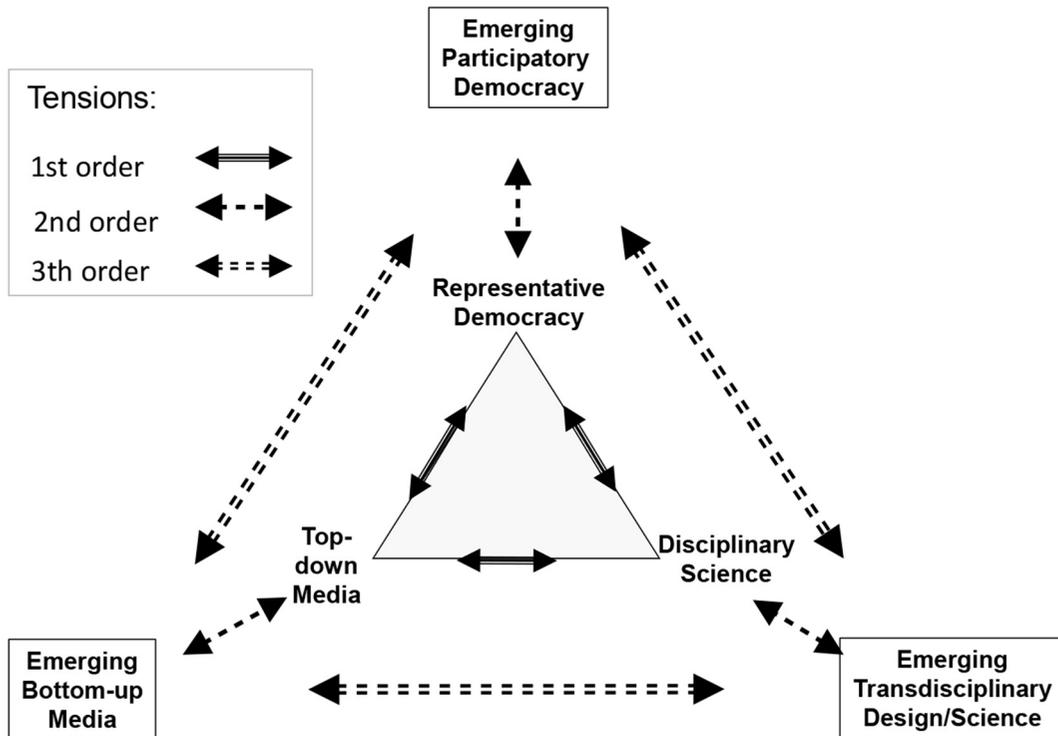
Advocacy coalitions between the proponents of a certain policy theory, the scientific representatives of related scientific theoretical viewpoints, and sympathetic NGOs and citizens' initiatives are born, live and disassemble later on.

## 1.4 Transdisciplinarity

Much valuable scientific work has been performed on the relationships between science and politics, in order to answer the last question at least partially. Jasanoff (1990, 2003, 2004, 2005) and others have argued that it would be wise to design an independent boundary function in order to foster the quality of the translation (Jasanoff/Martello 2004). The classical theory of boundary work in order to master the existing gaps between science and politics is nowadays widely accepted among experts. The underlying insight is that scientific knowledge by its very structure never directly relates to action, because it is fragmented, partial, conditional and immunized. This observation is valid for both mono- and multidisciplinary knowledge. So translation activities are always necessary in order to utilize scientific knowledge for policy purposes. Pohl, Scholz, Nowotny, Regeer, Bunders and many others have explored this vast domain and developed the concept of transdisciplinarity in a number of variations. The literature on transdisciplinary research is dominated by process-directed normative studies (see Bunders in In 't Veld 2010).

Many authors suggest that transdisciplinary research is just a specific category of scientific research, characterized by the acceptance of some normative

**Figure 1.1:** The emergence of the knowledge democracy concept. **Source:** The author.



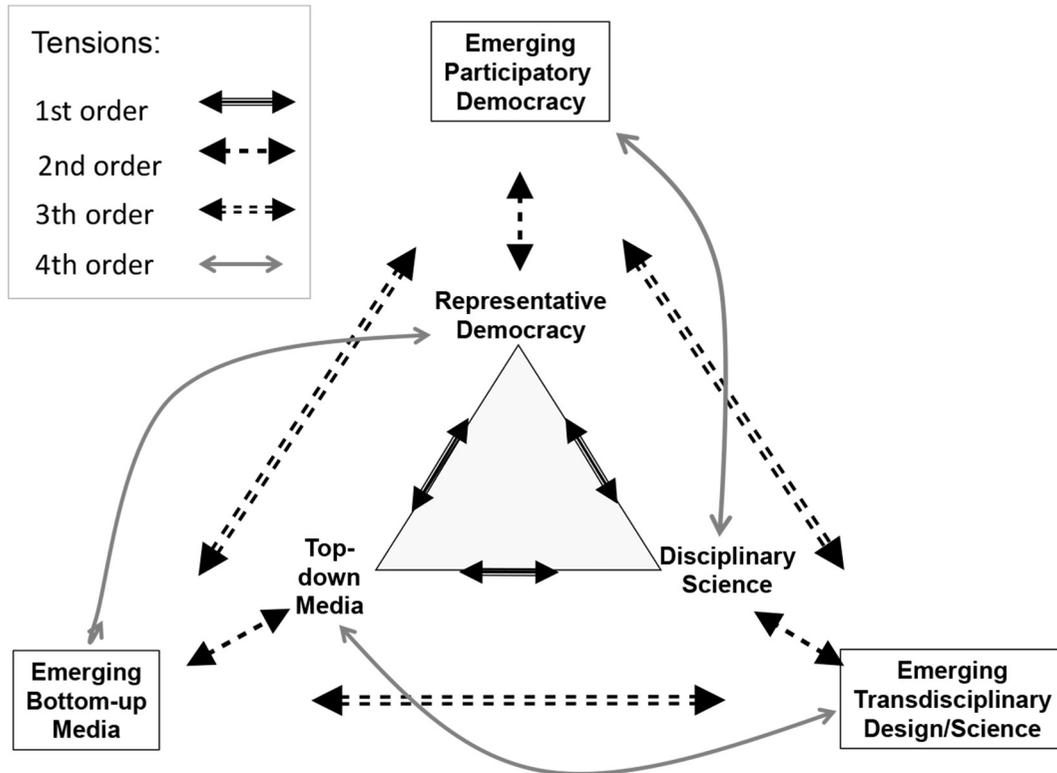
base for scientific reasoning. Here another viewpoint is defended: it appears clear that the core concept of transdisciplinarity is to be defined as the trajectory in a multi-actor environment, a trajectory that in due course leads from two sources: a political agenda and existing scientific expertise, to an acceptable robust, plausible perspective for action. This trajectory bears the character of a communicative and argumentative process (In 't Veld 2013). Its character is design. Funtowicz's later models contain both solutions and caveats on this thorny road (Funtowicz/Ravetz 1991, 1992, 1993).

Figure X.1 illustrates the twofold relationships between the corners of the triangle. The original, inner institutional framework was fit for the application of the fruits of disciplinary science, in order to solve rather simple policy problems within the framework of representative democracy. Society was ordered clearly in terms of ideological patterns, and classical top-down media fulfilled their roles. The first-order relationships show this picture. The second-order relationships describe the evolution of each corner. As a consequence of that evolution we are confronted with tensions, threats and opportunities around the outer corners of the triangle that are indicated in the third-order relationships.

As we may observe, the outer points of the extended triangle also strengthen and stimulate each other. Transdisciplinarity nears participatory democracy, and social media play crucial roles in large-scale communication processes. So the tensions relate mainly to the inside-outside relations in the triangle while the stimuli relate to the outer point of the corners. Hardly any empirical research is available yet.

Figure X.2 shows some of the relations between each inner and each outer corner. This type of relation also has far-reaching consequences for the governance of sustainable development in knowledge democracies. These fourth-order relations might prove to be very diversified: for instance, bottom-up media might be utilized by representative democracy but also cause conflicts as shown in the case study on vaccination. Citizens initiatives might internalize the fruits of disciplinary science, but this might also cause application problems. Top-down media might organize transdisciplinary trajectories, but they could prove to be boomerangs for those media themselves. In any society, a wide diversity of actors possesses relevant knowledge concerning important societal problems. In a knowledge democracy both dominant and non-dominant actors could and maybe should have equal access and ability to put this knowledge forward in the process of solving societal problems. We have

**Figure 1.2:** Old and new forms coexist and influence each other. **Source:** The author.



already explained why disciplinary knowledge on its own is not fit to solve broader societal problems.

During the past centuries the tendency towards specialization has dominated in science, destroying the practical meaning of the *homo universale*, and leading to more and more disciplines and subdisciplines. Sometimes innovation was brought about by new combinations of those, called multidisciplinary or interdisciplinary cooperation or even mergers.

According to the earlier terminology, transdisciplinary research developed during the 1980s and early 1990s. Multidisciplinary and interdisciplinary research then can be placed on a continuum between monodisciplinary research and transdisciplinary research. Thompson Klein, Grossenbacher-Mansuy, Häberli et al. (2001: 7) at the start of this century defined transdisciplinarity as:

A new form of learning and problem-solving involving co-operation between different parts of society and science in order to meet complex challenges of society. Transdisciplinary research starts from tangible, real-world problems. Solutions are devised in collaboration with multiple stakeholders.

So she already states that cooperation and mutual learning are key notions in transdisciplinary trajectories.

We observe, following Bunders and Regeer (2010), that in the scholarly literature the core of transdisciplinary research is most often presented as a shared set of principles. Principles differ from theories, methods, tools and conditions because they refer to the attitudes of the researcher-participant; the researcher is said to perform genuine transdisciplinary research as long as he or she acknowledges and acts in accordance with the intention of these principles. These principles relate to process demands such as joint problem definition, orientation towards robust action perspectives, and so on. As such, a set of principles describes the intentions that guide the researcher in choices he or she has to make for the design of the project or programme, that is, the choice of methods, tools and the sequence of these. In other words, ‘the approach’ is the manner in which the issue at stake is addressed. This is in line with the widespread convention of labelling specific realizations of transdisciplinary research as ‘approaches’.

If one concentrates on the essentials of transdisciplinarity as communication and argumentation, the demands for specific attitudes and even principles concerning the other participants besides researchers are as crucial. The policymakers will tend to accept those scientific viewpoints that are closely related to

the predominant policy theory, if present. They should, however, develop a certain willingness to open up to other scientific insights because the aim of the exercise could be to end up with resilient proposals, having answered the question of how to avoid disasters. This demands a sophisticated degree of reflexivity on their part.

Once all participants are touched by the need for mutual adapting, learning and the common goal of a resilient design, the transdisciplinary process could really be successful. Considering the existing literature, one might observe that these conditions are seldom fulfilled.

## 1.5 Agenda for the Future Organization of Science

Transitions and transformations are major changes that may contribute to sustainable development. There is an impressive number of studies available, also represented in this volume, on the character of these phenomena, under different names such as transformation theory, transition theory, etc. Above we argued that transdisciplinarity is a promising approach to tackling the wicked problems that emerge as we aim for sustainable development. Our analysis of knowledge democracies leads to specific questions about the organization of science in society in order to enable the coexistence of disciplinary research and transdisciplinarity.

In general, assuring the independence of scientific disciplinary research becomes more complicated as the interdependencies between politics, media and science become so intense and numerous. Reflexive mechanisms also considerably complicate the reactions of the public at large to scientific findings: the *Intergovernmental Panel on Climate Change* (IPCC) consensus on the causes of climate change irritated a large proportion of political actors and media so intensely that the support for sustainable policies declined. Each actor is involved in the interdependencies and turmoil of knowledge democracies: there is no outsider position available!

So consciousness of incompatible relations should increase. Scientific activities are performed by numerous organizations, by government and enterprises, by NGOs and by individual researchers, and most of all by specialized organizations devoted to research such as universities. One might say that society at large becomes a research institute.

Governments stimulate and finance research in order to further national competitive positions and innovation, and to contribute to an attractive cultural climate. The belief is widespread that expenditure on research and development causes economic progress without causing damage to other dimensions of societal evolution. Inside government the allocation of scarce resources to specific fields and objectives often leads to conflicts between the innovators on the one hand and the gatekeepers of academic excellence on the other. The latter defend the ideal of meaningful accumulation of knowledge while the former accentuate the need for applicability of scientific insights. Systematically of course both are complementary in nature, but the practice of budgeting in most cases is not adapted to that nature. These conflicts are reproduced nowadays within universities.

As the problematique of sustainable development bears a long-term, multilevel, complex character, the consistency and stability of science policies are of the utmost importance, but so also is free access to scientific sources for local and regional public authorities and citizens' initiatives. This is an essential characteristic of the governance of sustainable development.

In Europe, the scientific infrastructure is primarily connected to national decision-makers. Innovation, however, mainly originates in local and regional communities, so free access is necessary in order to strengthen the nature of participatory democracy.

Growing tensions surround the well-established prototype of the Humboldtian university with its accent on funding disciplinary research—at a distance from society—which is executed in absolute autonomy and 'disinterest'. This university will not show much sympathy for involvement in transdisciplinary trajectories. Academic excellence is here defined as excellence according to academic peers. The idea that there is more 'between heaven and earth' than disciplinary science alone, even in the realm of knowledge production, may be hard to digest for Humboldtian scientists.

The tradition of the American university—our reference concerns among others the University of California, Harvard and MIT—demonstrates a quite different picture: here the assignment of the university as an institution that considers itself obliged to render services to society—besides performing basic research—is rooted in centuries of institutional value formation.

European nation states have developed advisory bodies and semi-autonomous agencies in order to perform boundary work between the worlds of science and politics. If knowledge democracy is accompanied by an increasing degree of populism, political hostility

to these intermediaries grows fast, as can be seen now in Denmark, the Netherlands and France.

The wicked character of the sustainability problem necessitates transdisciplinarity, but political conflicts are often fought out here by playing two-level games. As the political controversy may lead to a dead end, an attractive strategy might be to accuse the knowledge source of the opponent of lack of trustworthiness. As the scientific experts are not present in the political arena, this type of indirect accusation will not stimulate the willingness of scientists to participate in transdisciplinary trajectories.

We foresee that in advanced societies the quantitative dimensions of research activities will still increase considerably, because a large proportion of the population will be capable of creating new knowledge, and productive activities will become still more knowledge-intensive. As a consequence, transdisciplinarity

and participatory democracy will become more closely interwoven.

The competences of scientists who are successful in transdisciplinarity are concentrated around empathy, and more on specific insights into the specific rationality of politicians.

Adequate governance arrangements in order to ensure acceptable equilibria between different modes of knowledge production demand redesign of the external and internal organization of scientific institutions.

More fundamentally, one could come up with an organizational logic that stimulates peaceful coexistence between the different research orientations in universities and the like that have just been mentioned. The organization of science is a focal issue in the pursuit of sustainable development.

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